

September 11, 2019

Ms. Marlene H. Dortch Secretary Federal Communications Commission 445 12th Street, S.W. Washington, DC 20554

Re: Liberty Defense Holdings, LTD. request for waiver of Sections 15.31(c), 15.503(d), 15.511(b), 15.511(f) and 15.521(d) of the Commission's rules ("Waiver"); ET Docket No. 19-217

Dear Ms. Dortch:

On September 9, 2019, Aman Bhardwaj and Bart Smudde of Liberty Defense Holdings, Ltd. ("Liberty"), along with Phillip Marchesiello and Mark Settle of Wilkinson Barker Knauer, LLP and Edward Lyvers and William Moulder of MIT Lincoln Laboratory, met with the following members of the Office of Engineering and Technology ("OET"): Jamison Prime, Michael Ha, Karen Rackley, and Aole Wilkinsel (by phone).

Liberty discussed its HEXWAVE weapons detection technology and the public interest benefits that will be achieved by a grant of the Waiver sought by Liberty in connection with the HEXWAVE product to enable Liberty to secure an equipment authorization for the HEXWAVE product.¹ A copy of a presentation used by Liberty during the meeting is attached.

Liberty explained that it has been performing testing of HEXWAVE under an experimental license that OET granted to Liberty.² The results of that testing have helped Liberty evolve the range of technical parameters that Liberty set forth in its Waiver. Specifically, Liberty proposes to hereby revise the Waiver as follows:³

¹ See Office of Engineering and Technology Extends Comment Cycle Deadlines on Liberty Defense Holdings, Ltd. Request for Waiver of Certain Part 15 Ultra-Wideband (UWB) Rules, Public Notice, ET Docket No. 19-217, DA 19-898 (OET rel. Sept. 11, 2019); Office of Engineering and Technology Seeks Comment on Liberty Defense Holdings, Ltd. Request for Waiver of Certain Part 15 Ultra-Wideband (UWB) Rules, Public Notice, ET Docket No. 19-217, DA 19-706 (OET rel. July 25, 2019).

² See, Liberty Defense Experimental License, FLN 0109-EX-CN-2019.

³ During Liberty's meeting with OET, OET indicated that Liberty may adjust certain technical parameters in its Waiver Request via this *ex parte* notice, provided that Liberty continues to comply with the other technical requirements for UWB surveillance systems. If OET instead would like Liberty to file a supplement to the Waiver to reflect the foregoing minor adjustments, please let us know. Liberty would be glad to do so.



- The UWB waveform will consist of a number of sets of either three or four chirplets (as such term is used in the Waiver).
- Each chirplet will span up to 200 MHz and thus each set of three or four will be up to a maximum 800 MHz wide.
- There will be an "RF off" period of up to 100 nanoseconds between chirplets.
- Combined, the sets of chirplets will sweep the full band of operation (i.e., from 6.0 to 10.6 GHz).
- The total transmit cycle time will be less than 54 milliseconds and will be repeated with a period of no less than 100 milliseconds.

In addition, in its Waiver, Liberty indicates that the HEXWAVE antenna will be composed of 3072 unique transmit/receiver element pairs and that these "phase centers" can be scanned using 1536 individual transmissions by using two receivers. Liberty now intends to use the 3072 unique phase centers as the upper limit of transmit/receive element pairs. For this reason, Liberty requests for the FCC to provide Liberty with flexibility to use single receiver systems or systems with custom transmit/receive elements, provided that the system continues to meet the technical requirements for operation of a UWB surveillance system.

Liberty also discussed with the OET staff the request in Liberty's Waiver for private security professionals to be deemed eligible users of the HEXWAVE system so that the system may be marketed to, and operated by, such private security professionals. The OET staff asked Liberty to propose a more formal definition for the term "private security professional," which Liberty will do in the record in this proceeding via a further supplement to its Waiver that Liberty will file shortly.



Pursuant to Section 1.206 of the Commission's rules, this *ex parte* notice is being filed electronically via the Electronic Comment Filing System in the above-referenced proceeding. Please do not hesitate to direct any questions about the foregoing to the undersigned.

Respectfully submitted,

LIBERTY DEFENSE HOLDINGS, LTD. DBA LIBERTY DEFENSE TECHNOLOGIES

/s/ Aman Bhardwaj

Aman Bhardwaj President 2 Sun Court, Suite 230 Peachtree Corners, GA 30092

Phillip R. Marchesiello, Esq. Mark A. Settle, P.E. Wilkinson Barker Knauer, LLP 1800 M Street, N.W. Suite 800N Washington, DC 20036 (202) 783-4141

Counsel for Liberty

Attachment

cc: Jamison Prime

Michael Ha Karen Rackley Aole Wilkinsel



HEXVVVE

INNOVATIVE & REVOLUTIONARY THREAT DETECTION



Protecting communities and preserving peace of mind through superior security detection solutions.

HEXWAVE will be able to:

Detect
Metallic &
Non-Metallic
threat objects

Overtly and Covertly be installed in locations

Support Indoor & Outdoor applications out to perimeters

Protect privacy by collecting / analyzing no personal data Accurately detect threats in Real-time using Artificial Intelligence and Deep Learning

The Urban Security Threat - Characteristics



THREAT IN URBAN SECURITY HAS EVOLVED AGAINST "SOFT TARGETS"

- Trending towards mass attacks (shootings, bombings)
- General mode of attack unchallenged entry into a venue with a military style weapon, blade or explosive that has high volume lethal capacity

MASS SHOOTINGS IN THE USA1



Attack Transition Time

- Outside ← Gate/Door ← Indoors
- Immediate / Opportunistic Calculated / Position

Weapon Destructive Capacity drives need for

- Interdiction before attack
- Immediate intervention precise deployment, lock-out

Need to "buy time" for response to (1) isolate / contain, (2) deploy response



Societal Impact of Urban Security Threat



- Safety of Citizens
- Public Confidence
 - Sense of fear and eroded "peace of mind"
 - Shift to protection/isolation vs active participation
- Direct Business Economics
 - Reduced attendance at events
 - Facility damage
- Liability Expenses
 - Non value add burden to businesses, government



of Americans are concerned about a CRIMINAL ATTACK causing physical harm at large-scale events



of Americans have considered cancelling plans to attend large-scale public events due to concerns about PHYSICAL ATTACKS and DATA SAFETY



Crowd Panic from motorcycle backfire in NYC

^{1 -} https://www.cbsnews.com/news/motorcycle-backfire-in-times-square-shooting-fears-scare-crowd-mistake-sound-for-gunshots-nyc-theater-district/

^{2 -} https://www.unisys.com/

The Urban Security Threat – US



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- Entry points generally use "point detection and response solutions"
- Need to "buy time" for response to (1) isolate / contain, (2) deploy response

NEED FOR LAYERED, STAND-OFF DETECTION CAPABILITY

- Capability that can detect threats and enable security to respond before an attack occurs
- Perimeter screening through outdoor portals provides stand-off "safe zone"
- Low impact, positive customer experience

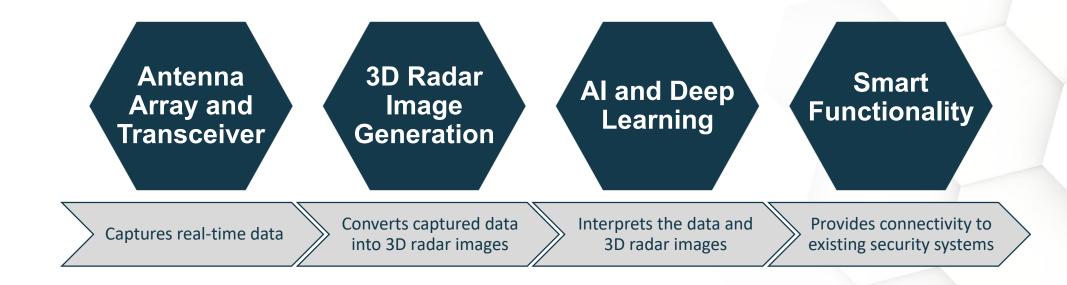
How - LOW-COST SOLUTION FOR ACCURATE, REAL-TIME WEAPON DETECTION

- Screens high-volume foot traffic
- Enables designation and segregation of threats, both indoors and outdoors
- Relieves or minimizes burden on security screeners

What is **HEX**WAVE?



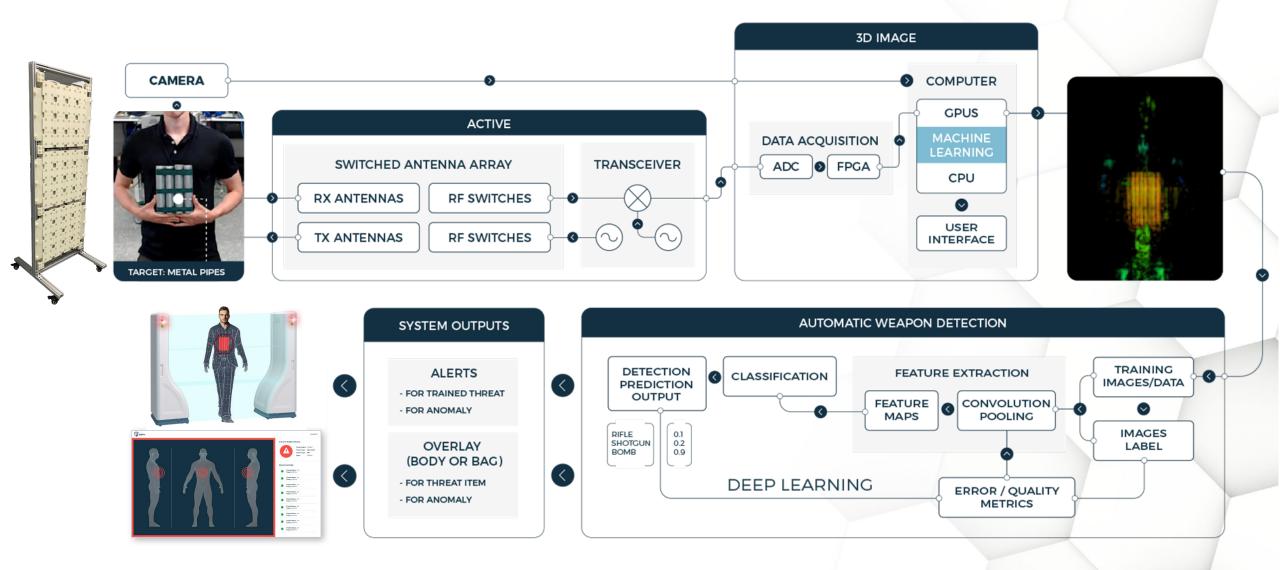
HEXWAVE is Liberty's proprietary weapons detection product and consists of four major subsystems that work together:



No personally identifiable information is collected or viewed by the security team or other operations personnel, which protects the privacy and modesty of individuals.

Active 3-D Threat Detection

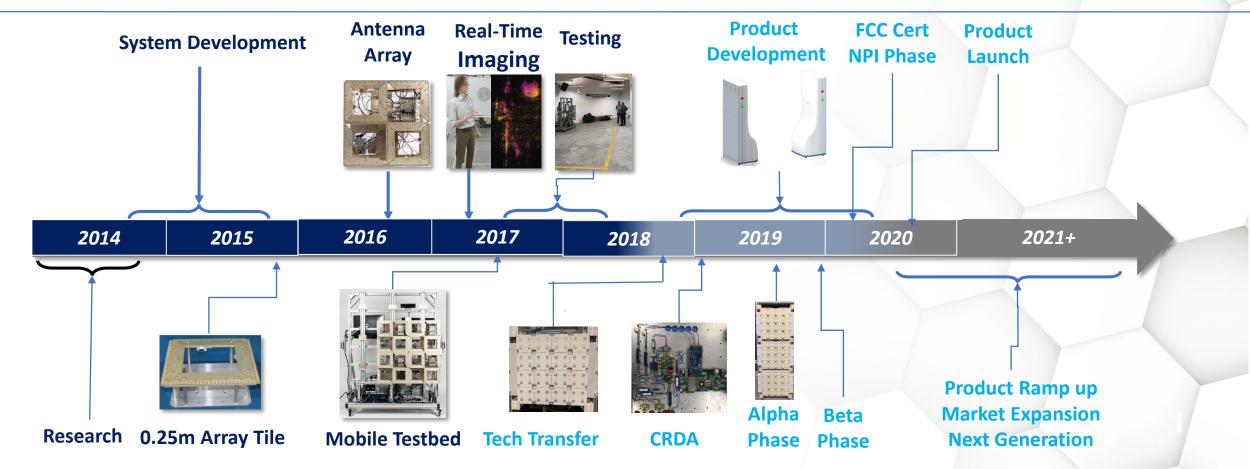




Real Time Active 3D Imaging – Tech to Commercialization



- ✓ 4+ years of technology development and testing at MIT Lincoln Lab
- ✓ LDT has an exclusive global license for the technology (patent expiration in 12/17/2035)
- ✓ LDT has completed Tech Transfer and completed 2 phases out of 3 for CRDA development
- ✓ Technology improvements for commercialization (Antenna Array, UWB Transceiver, AI, UI, Product, Regulatory, Safety)



IP - Global Reach



(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2017/0227636 A1 Moulder et al.

(43) Pub. Date: Aug. 10, 2017

(54) METHODS AND SYSTEMS FOR NEAR-FIELD MICROWAVE IMAGING

(71) Applicants: William F. Moulder, Nashua, NH (US); James D. Krieger, Cambridge, MA (US); Denise T. Maurais-Galejs, Carlisle, MA (US); Huy Nguyen, Burlington, MA (US); Jeffrey S. Herd, Rowley, MA (US)

(72) Inventors: William F. Moulder, Nashua, NH (US); James D. Krieger, Cambridge, MA (US); Denise T. Maurais-Galejs, Carlisle, MA (US); Huy Nguyen, Burlington, MA (US); Jeffrey S. Herd, Rowley, MA (US)

(21) Appl. No.: 15/262,687

Sep. 12, 2016

Related U.S. Application Data

(60) Provisional application No. 62/268,559, filed on Dec.

Publication Classification

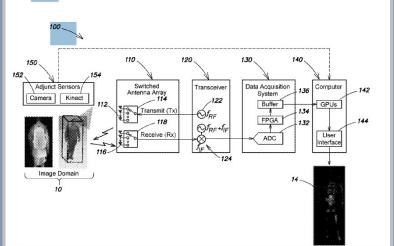
(51) Int. Cl. G01S 13/89 (2006.01)G01S 13/88 (2006.01)G01S 13/00

(52) U.S. Cl.

G01S 13/89 (2013.01); G01S 13/003 (2013.01); G01S 13/887 (2013.01)

ABSTRACT

A multistatic array topology and image reconstruction process for fast 3D near field microwave imaging are presented. Together, the techniques allow for hardware efficient realization of an electrically large aperture and video-rate image reconstruction. The array topology samples the scene on a regular grid of phase centers, using a tiling of multistatic arrays. Following a multistatic-to-monostatic correction, the sampled data can then be processed with the well-known and highly efficient monostatic Fast Fourier Transform (FFT) imaging algorithm. In this work, the approach is described and validated experimentally with the formation of high quality microwave images. The scheme is more than two orders of magnitude more computationally efficient than the backprojection method. In fact, it is so efficient that a cluster of four commercial off-the-shelf (COTS) graphical processing units (GPUs) can render a 3D image of a humansized scene in 0.048-0.101 seconds.



Country	Filing Date	Status
United States	9/12/2016	Granted
United Arab Emirates	6/14/2018	Pending
Australia	5/11/2018	Published
Canada	5/9/2018	Pending
China	6/15/2018	Pending
European Patent Office	7/17/2018	Published
India	5/15/2018	Published
Japan	6/11/2018	Pending
Republic of Korea	7/6/2018	Published
Mexico	9/12/2016	Published

MARKET **VALIDATION**



Liberty Defense's agreements include beta testing with:

OROGERS ARENA









ROGERS ARENA

Rogers Arena - Vancouver, Canada; home of the Vancouver Canucks and one of the city's main large-scale entertainment venues

SLEIMAN ENTERPRISES

Sleiman Enterprises - one of Florida's largest privately held real estate companies; develops and manages shopping centers, malls, hotels throughout Florida and Southeast Georgia

OFFICE OF THE UTAH ATTORNEY GENERAL

The Attorney General is an independently elected constitutional officer of the executive department and serves four-year terms. The current Utah Attorney General is Sean Reyes

FC BAYERN MÜNCHEN

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A German sports club, best known for its professional football team, the most successful club in German football history, having won a record 29 national titles and 19 national cups. Allianz Arena is the second largest arena in Germany

VIRGINIA DIVISION OF CAPITOL POLICE (VDCP)

The USA's oldest police force which is responsible for the security of Virginia's seat of government. The VDCP protects the Virginia Capitol complex, including screening about a half-million visitors each year

HEXWAVE – Central to Facility Layered Defense





Object & Anomaly Detection

Metallic & Non-metallic threats



Non-Threats

Identifies common objects and does not alarm



Real-time

Walk at normal pace with less divestment



Artificial Intelligence

Deep neural networks and anomaly detection



Privacy Protection

No personally identifiable information gathered or used



Versatile & Robust

Indoor and Outdoor use Weather and Dust protection



Flexible / Installation

Overt, Covert, Remote, Mobile,





High Throughput

Allows for >1000 people per hour



Integration

Integrated with access control and surveillance infrastructures



Onvif°

Standardizing IP Connectivity for Physical Security



Analytics

Aggregates data for reporting



Modular

Stand-alone panels allow for different configurations



Environmental Immunity

Unaffected by temperature, proximity to metal, room setup, etc.



Network Security

Secure protocols used to protect resources & data

HEXWAVE Device... Full-body Standoff Detection



Threat detection (Object & Anomaly)

- Metallic
- Non-Metallic
- Real-time (< 0.2 sec)
- Uses AI & Deep Learning

Smart Device

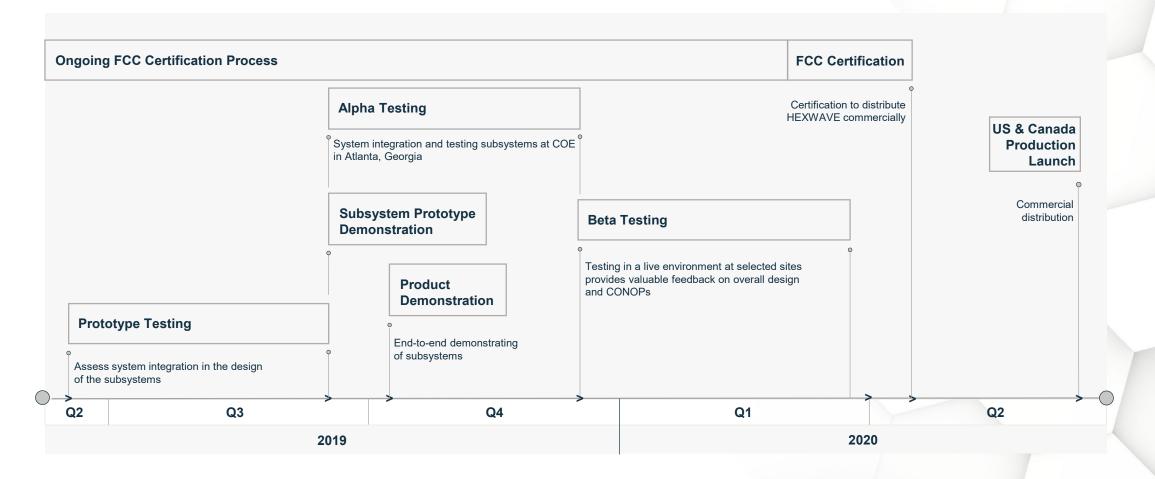
- Application- Tablet, Laptop, PC
- Network Connectivity –WIFI, Ethernet
- Remote operation
- Shares data (analytics)
- Integrates with surveillance and access control (ONVIF profiles)
- Computing power (CPU, GPU, FPGA)
- Software updates
- Covert and overt application
- Indoor and outdoor applications

Threats	Image	Size		Comment	
Glock 17		Full-size		9mm	
Glock 26		Subcompact	t	9mm	
Ruger LCRx		Compact		.38 Special	
AR-15 Semi- Automatic Rifle		Full Size		.223	
Pump-action Shotgun		Full Size		12 Gauge	
Pipe Bomb		Varies	٨	Ion-Metallic or Metallic	
Flares		Standard		Plastic or paper, sulfur, aluminum, magnesium	
Smoke Bombs	SMUKES OO	Standard		Plastic or paper Potassium nitrate	
Non-Threats	Image		Size	Comment	

Non-Threats	Image	Size	Comment	
Cell Phones		Varies		
Keys		Varies		

LIBERTY DEFENSE SUCCESS - MOVING FORWARD





Continuing Catalysts - Ongoing Market and Technology Validation through Collaboration Agreements

Summary





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NEED FOR LAYERED, STAND-OFF DETECTION CAPABILITY

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- Screens high-volume foot traffic
- Enables designation and segregation of threats, both indoors and outdoors
- Relieves or minimizes burden on security screeners

HEXWAVE – key to the urban security solution

- Metallic / non-metallic weapon detection
- Real-time accurate detection using Artificial Intelligence and Deep Learning
- Modular & Scalable to facility Indoor / Outdoor, Covert / Overt deployment
- Central to a positive customer environment

Appendix



Waiver request and proposed conditions

HEXWAVE UWB Surveillance waveform

Private security and law enforcement

Waiver Request



Waiver Request

- 15.31(c) Use alternate measurement with frequency sweep active (instead of frequency sweep stopped)
- 15.503(d) Use of 3 chirplets grouped together spanning 600MHz (instead of 500 MHZ BW)
- 15.511(b) User eligibility: allow security professionals to operate HEXWAVE system (in addition to law enforcement)
- 15.511(f) Add private security professional to the list of eligible users on equipment label.
- 15.521(d) Alternative measurement procedures

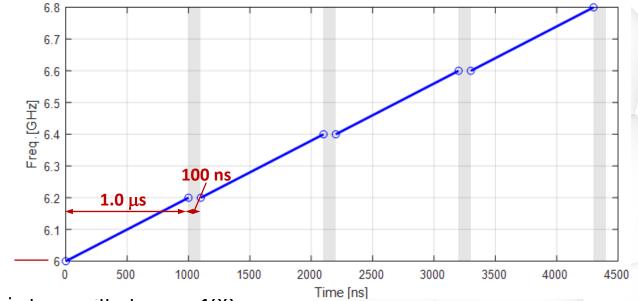
Proposed Conditions

- Will comply with the technical specifications under Part 15 of 47 C.F.R except for waivers.
- Each HEXWAVE system shall bear the following statement on the device "Operation of this device is restricted to law enforcement, fire and rescue officials, private security personnel, public utilities, and industrial entities. Operation by any other party is a violation of 47 U.S.C. 301 and could subject the operator to serious legal penalties."
- Operations under this waiver will be limited to law enforcement and private security personnel
- Liberty shall create and maintain a record of all installations operating under this waiver (Smart feature)
- Liberty shall inform purchasers that they can't sell the device without prior notice to Liberty.

HEXWAVE: Ultra-wideband (UWB) Surveillance System



- Proposed waveform is for an UWB surveillance system, whose emissions are governed by 47 CFR 15.511
- Swept-frequency system operating in 6.0-10.6 GHz frequencies
- Bandwidth of each chirplet is 200 MHz with duration of 1usec with separation of 100ns (no emissions)
- The 800 MHz-wide waveform is transmitted for each of the antenna phase centers / 2 (1536) This requires 6.6048 ms (1536 * 4.3 μs)
- The Local Oscillators are then retuned and the waveform is transmitted (1536 times for each band) for:
 - 6.8–7.6 GHz
 - 7.6-8.4 GHz
 - 8.4-9.2 GHz
 - 9.2-10.0 GHz
 - 10.0-10.6 GHz (3 chirplets)



The entire waveform (of duration 31.4544 ms) is transmitted every 100 ms

Private Security & Law Enforcement



Policing is carried out by a network of public police and private security that is often overlapping, complimentary and mutually supportive. Within this context, it is increasingly difficult to distinguish between public and private responsibilities

- Public Private partnership varies from national level (information sharing) to local level (operational)
- Many types of structures or partnerships for Public and Private are in practice (NIJ study)
 - Information-sharing networks straddling the public and private sectors.
 - Subsets of public policing functions being contracted out to private industry.
 - Public police office working for private clients under a variety of different arrangements.
 - Not-for-profit associations forming, with membership from public and private organizations, allied around some common security-related purpose.
 - Public police also cooperate on a daily basis with security guards and patrols operating in privately owned or quasi-public spaces, such as shopping malls, industrial complexes, private universities
 - Police routinely rely on private security to assist in their investigations.
- Private security can take a lead role with coordination with law enforcement or take a supporting role to law enforcement

Private Security and Law Enforcement



Law Enforcement

- Special Legal Powers
- Extensive Training

Private Security

- Size (3x) plus growing
- Special topic expertise/resources

Operation cooperation guidelines – Department of Justice

- Networking and the personal touch.
- Collaboration on specific projects (mass casualty, high-tech crime).
- Increased crime prevention and public safety.
- Cross-fertilization (use of technology).